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MILK PRICING IN KENYA. THE CASE OF
A BULKY, PERISHABLE COMMODITY WITH
SEASONALLY VARYING PRODUCTION COSTS

by

Peter Hopcraft

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INSTITUTE FOR DEVELOPMENT STUDIES
UNIVERSITY OF NAIROBI
P.O. BOX 30197
NAIROBI, KENYA

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ABSTRACT

As with a number of other bulky and perishable agricultural commodities, milk has production costs that vary markedly with the season. Following the rains these costs are low, in the dry season they are far higher. With a price that is uniform between seasons, these cost differences result in enormous fluctuations in milk deliveries depending on the season. Transport and storage costs for milk are high with the implication that location is also an extremely important consideration in pricing. A uniform price between surplus and deficit areas implies large differences in the economic costs of delivered milk, a substantial transport subsidy, and an inappropriate stimulation of production in areas that are far from the market.

This paper analyses the issue of milk pricing given the above phenomena including the issue of the local demand for milk within the rural areas. The reasons for the chronic financial crisis of the KCC (Kenya Cooperative Creamery) are evident from the analysis. The use of politicized prices that ignore the economic and technical characteristics of commodity production and consumption is questioned.

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Peter Hopcraft^{*}

Official price interventions, generally resulting in some kind of a fixed price have become common place in a number of countries. Quite generally the official decisions regarding pricing are made with scant reference to the technical or the economic issues that determine the marginal cost or value of the commodity to the society concerned. In particular, a bulky commodity that has high transport costs per unit value can be expected to have a price that is location - specific, and a perishable commodity that has seasonally varying production costs and high storage costs can be expected to have a price that is time-specific. Such commodities obviously do not lend themselves well to price-fixing measures; chronic financial problems, and problems of shortages and surpluses, can confidently be predicted to follow such measures.

The dairy industry in Kenya is currently experiencing a severe financial and economic crisis that can be traced directly to price policy problems. Quite apart from highly undesirable effects on efficiency, on income distribution and on welfare, present policies have led to a situation where the dairy industry has become a drain on, rather than a contribution to, the public fisc. Government guaranteeing of huge overdrafts is already going on, and this is a short step away from outright subsidies.

This paper will offer a brief analysis of the price issue for milk, the case of a commodity with production costs that vary between seasons, and for which storage and transport costs are high. It will then look specifically at the effects of a seasonally and locationally uniform price as it is imposed in Kenya on the dairy industry.¹

1. VARIATION IN THE VALUE OF MILK AT DIFFERENT TIMES AND IN DIFFERENT PLACES

One of the most significant features of a bulky, perishable commodity such as milk is that its value is highly dependent on its location and on timing. The reason why location is significant is that transport costs are

* Peter Hopcraft is Senior Research Fellow, Institute for Development Studies, University of Nairobi.

1. Readers interested in more detailed data and analysis of the dairy industry in Kenya are referred to Peter Hopcraft, et. al., An Evaluation of the Kenya Dairy Production Improvement Programme. Occasional Paper No. 20.

real economic and financial costs, and in the case of milk they are high. The price of milk at any market must reflect the price paid to the farmer plus the cost of transporting the milk to that market (abstracting, for the moment, from any processing costs). If the price at the market is P_m , and the cost of transporting milk from the farm to the market is T , which is dependent on d , the distance between farm and market, then the farm price, P_f , in any particular location can be written as:

$$P_f = P_m - T(d)$$

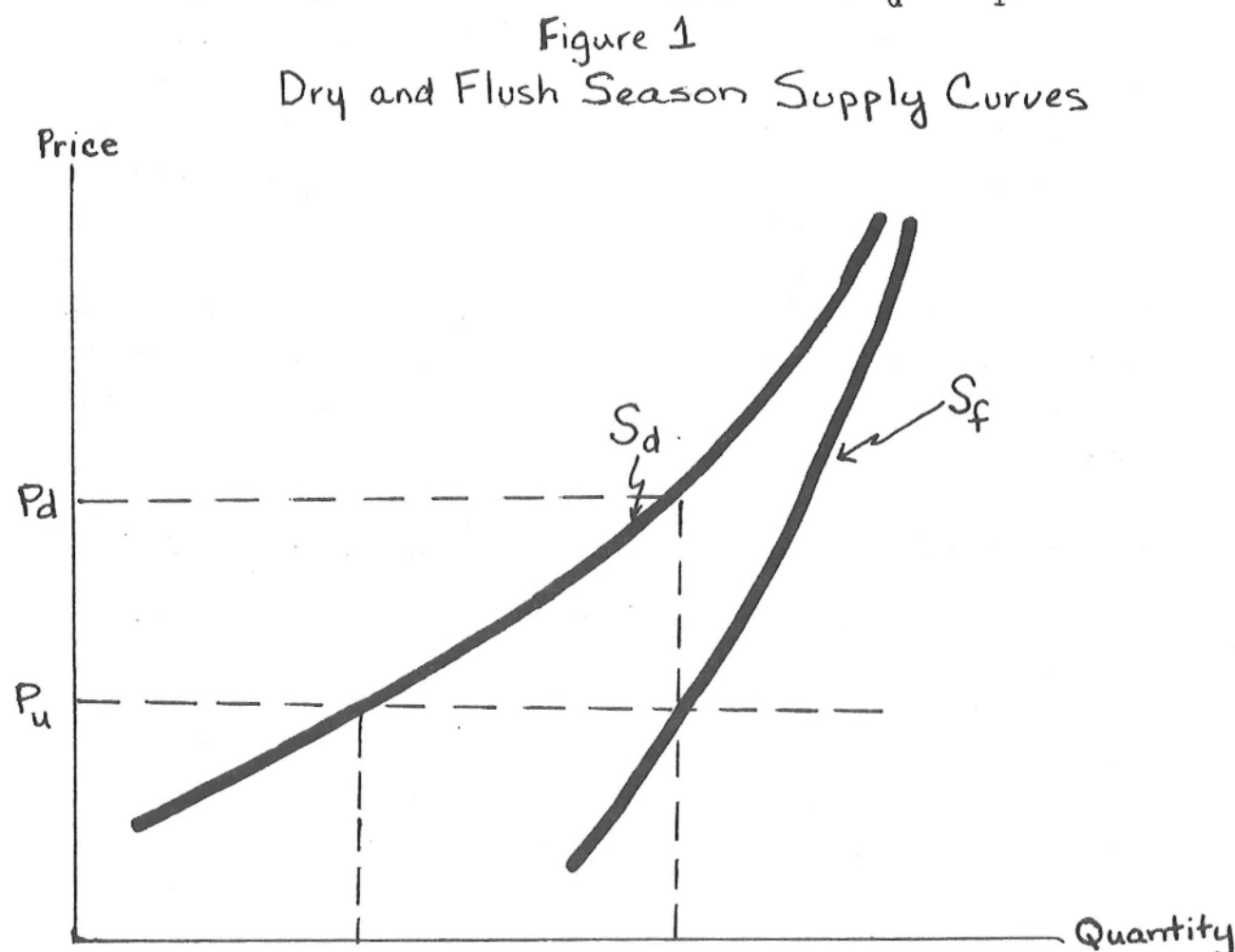
For any given price in the consuming area, the higher the cost of transport (the greater the distance between that area and the producing area) the lower will be the value of milk in the producing area. The value to the economy of additional milk produced is specific to each location. The effect of paying a price that disregards transport costs and is uniform for all locations is the excessive stimulation of production far from the consuming area. The result must be to increase the financial outlay for the transportation of milk from those more distant places so that the total cost of milk to the economy, which must certainly include all transport costs, is higher than it would otherwise be. The effect of hiding the transport costs from producers and consumers is that those costs grow to be much larger than they would otherwise be.

The reason why the timing of supplies is important relates to the cost or feasibility of storage. If a family consumes 50 kilos of ripe tomatoes in a year, they would not necessarily appreciate the year's supply delivered in one day. The same is true for milk. Additional supplies when the current demand for fluid milk is met do not have the same value as additional supplies when a shortage exists. The value to the economy of additional milk produced is therefore specific to the time it is produced. In periods of scarcity this value may be very high. In periods of surplus it can be much lower. If processing facilities are already used to capacity, additional milk may become more of a problem than a benefit. There have been times and places in Kenya where large quantities of milk were poured down the drain (despite there being large numbers of needy people in the country who would have happily consumed it). Flush season surpluses which can only be processed and sold at a loss are certainly no financial benefit to a milk marketing agency.

2. SEASONAL VARIATION IN THE COSTS OF MILK PRODUCTION

The costs of producing milk vary among areas depending on the opportunity costs of the various resources used for the production of milk. For any given area, however, there can be enormous differences in the costs of maintaining milk supplies, depending on the season. In the flush season, generally following the rains, cattle feed is in plentiful supply at a low cost. For many farmers in this season grazing meets the full feed requirements of their dairy cattle and supplementary feeding is not undertaken at all. (Feeding systems differ between areas, but as long as the availability or cost of feed varies according to the season of the year this analysis holds.) In the dry season, on the other hand, when cattle feed becomes scarce and more expensive, the costs of maintaining milk supplies can increase enormously. Unless the producer incurs the very considerable expense of storing or purchasing feed for this dry period, milk production will drop off sharply.

Figure 1 specifies two seasonal supply curves, S_d and S_f , which



indicate the quantity of milk that farmers will produce in the dry season and in the flush season, depending on the price they receive. At a uniform price per litre between seasons, P_u , farmers will produce a quantity of milk Q_f in the flush season, but will reduce production down to Q_d in the dry season. If the supply of Q_f is to be maintained in the dry season, farmers would need to incur very greatly enhanced production costs which would require a dry season price rise to P_d . In this model, the flush season price must fall again to P_u if flush season supplies are not to exceed Q_f . (In the figure, only two supply curves are described. In fact, a continuous family of supply curves can be visualized between them.)

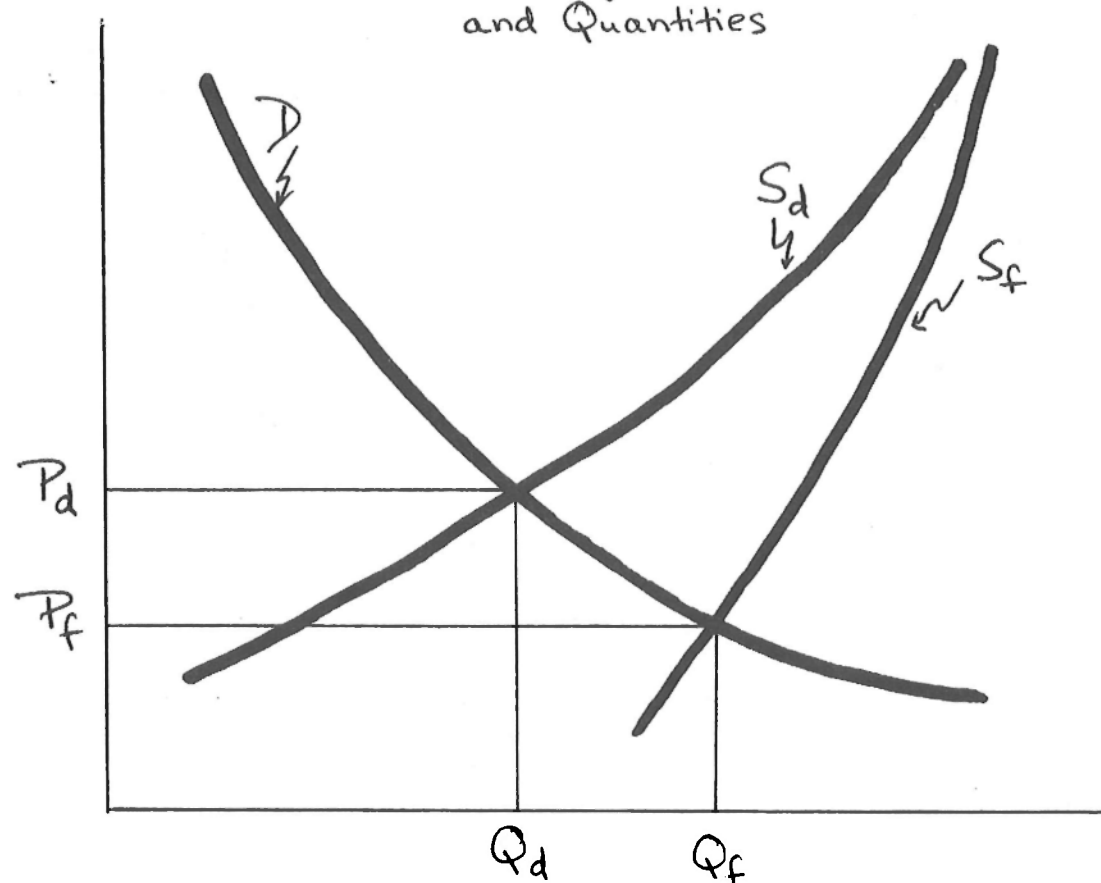
It will be observed from the way in which the two supply curves are drawn that the price elasticity of supply is a great deal higher in the dry season than it is in the flush season. That is, a given percentage increase in price results in a far greater percentage increase in supply in the dry season. In the flush season, dairy cows will tend to be fairly well nourished for a wide range of milk prices so that the quantity of milk produced will be fairly insensitive to price. In the dry season the opposite is the case. Unless the milk price is adequate (or some other motivation exists) the farmer will not be able to incur the costs of the supplementary feed and management necessary to maintain dry season supplies. If supplementary feed is not provided, milk production will drop off rapidly due to poorer dairy cow nutrition. If the farmer is motivated and enabled to incur the costs of supplementary feed in the dry season, the effects on the yields of dairy cows can be very marked because of the shortage of feed they are otherwise experiencing. Supply will therefore increase substantially.

3. CONSUMER DEMAND AND THE SEASONALLY FLUCTUATING EQUILIBRIUM PRICE

Figure 2 introduces a consumer demand curve, D , into the model. This curve relates the quantity demanded by consumers to the price of milk. The shape of the curve as it is drawn reflects the evidence that among low-income consumers the demand for milk is price elastic. That is, a given increase (or decrease) in the price of milk results in a greater proportional decrease (or increase) in the quantity that

consumers wish to purchase. Among richer consumers the demand for

Figure 2
Seasonal Equilibrium Prices
and Quantities

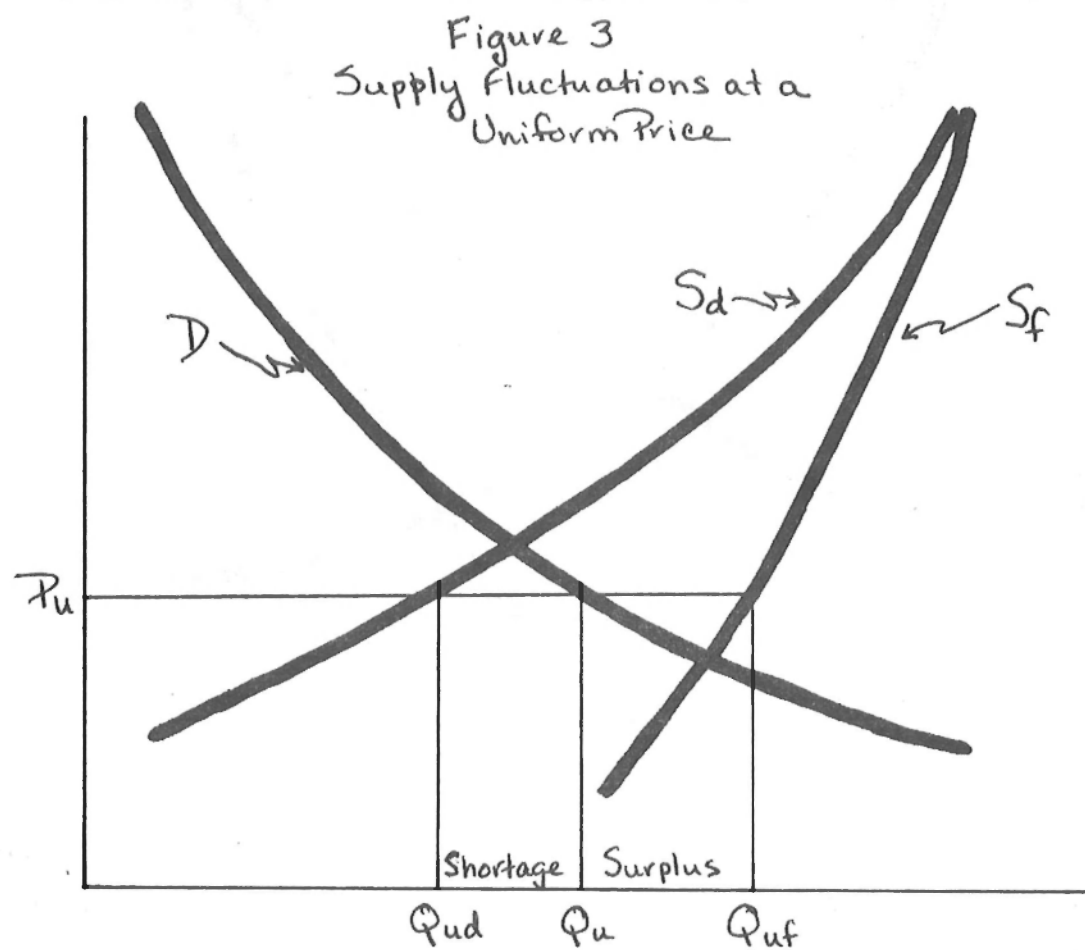


milk tends to be inelastic - they will buy what milk they want regardless of the price. The milk purchases of poorer consumers, however, vary markedly with price. For such consumers, milk tends to have the characteristics of a luxury.

Given the supply and demand curves as they are drawn in Figure 2, the market clearing or equilibrium prices and quantities can now be specified for each season as the intersections of the demand curve and the seasonal supply curves. For the dry season these are P_d and Q_d , and for the flush season P_f and Q_f . In the absence of controls and price distortions in the market, both quantities and prices would fluctuate depending on the consumer's willingness to pay and the producers willingness and ability to produce at that price. This is precisely

perishable commodities with seasonally specific production costs. Unlike supply, there is no reason to expect the demand curve to shift with the seasons. (Autonomous shifts in the demand curve are to be expected as a result of such factors as population and income changes, but these are not included in a static price analysis.)

In Figure 3 a uniform price between seasons, P_u is imposed on the model. The amount demanded by consumers at that price is Q_u throughout the year. The amount supplied by producers, however, varies



between seasons. In the flush season it is Q_{uf} so that a surplus exists of $Q_{uf} - Q_u$. In the dry season the amount supplied is Q_{ud} . Since consumers still wish to buy Q_u at that price, there is a shortage or 'excess demand' of $Q_u - Q_{ud}$.

In general it is possible to say that surpluses and shortages cannot be sustained in a free market. The price of a commodity will fall if there is a surplus and will rise if there is a shortage. Any attempt to impose a uniform price on a perishable product with seasonally varying costs of production can only be carried out with a huge and wasteful expenditure of resources. Because of the costs of storage, the value (the real economic price) of milk must be seen as varying with the season as well as with the location of production.

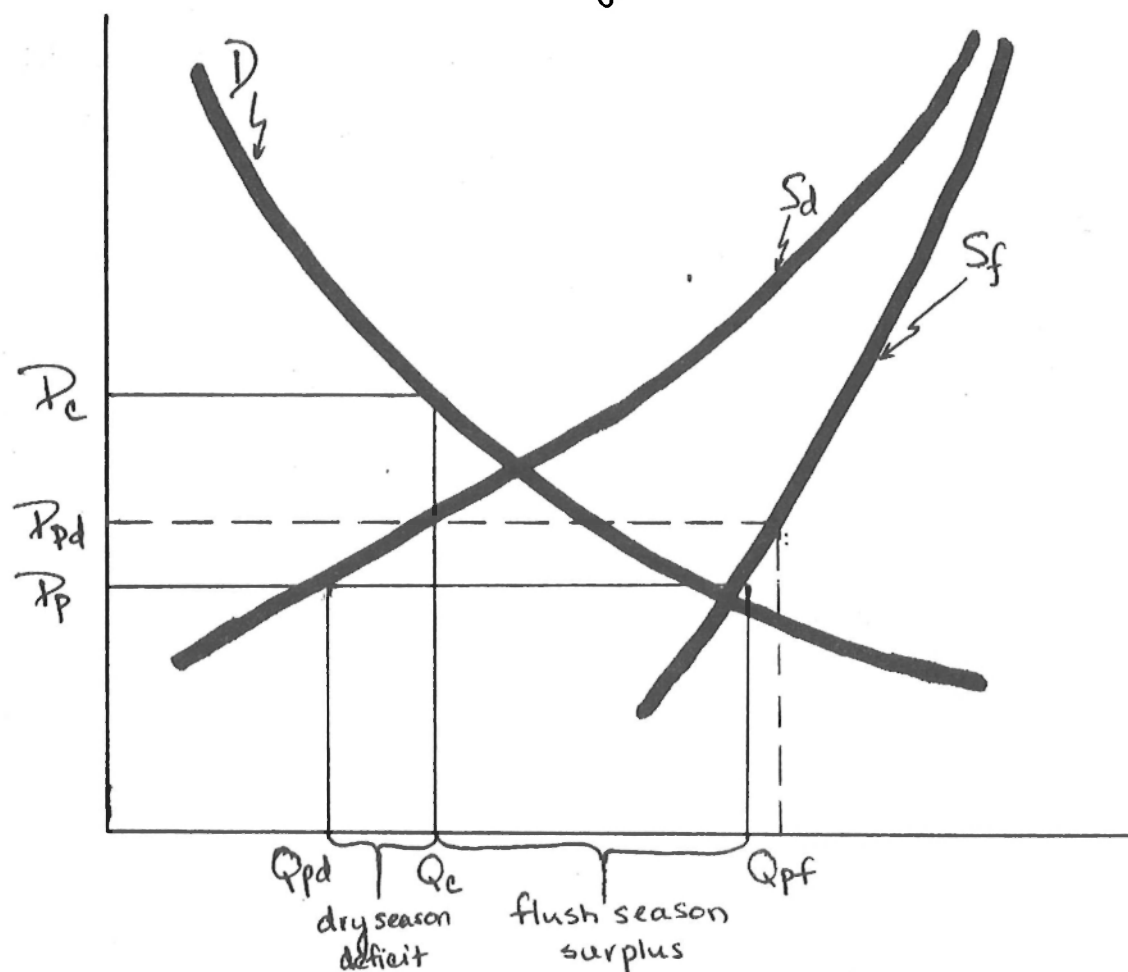
4. KENYA: THE CASE OF A SEASONALLY AND LOCATIONALLY UNIFORM MILK PRICE

Prior to July 1970, production supplies were maintained in Kenya by the quota system. This system involved paying the quota owner a premium for a specified quantity of milk that must then be delivered daily throughout the year, or the quota was forfeited. In effect the producer was rewarded for maintaining production in the dry season, which may have been done at a loss, by receiving a substantially higher price than he otherwise would for milk produced in the flush season when his costs were low. Quotas changed hands between farmers, at a price, and the system functioned to even out milk supplies over the year. Price differentials were also paid between regions so that the price paid for milk received in a depot of the Kenya Cooperative Creamery (KCC) in a surplus area was less than that paid in a deficit area depot.

In 1970, the inequities and rigidities of the quota system in the Kenya context led to its abandonment. Since then, despite the stated intention of the KCC to pay a premium for milk delivered in the dry season when liquid milk is scarce, the milk price to both producers and consumers has changed from time to time (always in the upward direction) but has been uniform between seasons. This has led not only to a highly irrational pattern of locational production, involving the KCC in huge transport costs, but also a pattern of seasonal shortages and surpluses that have resulted in perennial financial crises for the KCC. Unfortunately these financial crises have led to price changes which appear to relieve the situation but in fact worsen it in all but the short run. Perhaps the most basic problem is that the producer milk price has, unlike the price of tomatoes for instance, become politicized to the extent that economic and financial issues have been virtually ignored.

The general pattern in the formal (KCC-organized) market for milk over the recent years can best be illustrated by Figure 4 which utilizes the same supply and demand functions that have been used in the other three figures. The producer price P_p is paid by the KCC at a uniform level per litre throughout the year. The result is very large and growing

Figure 4
K.C.C. Pricing Behavior



seasonal fluctuations in milk delivered. In the flush season very large deliveries, Q_{pf} in Figure 4, are made to the KCC. In the dry season, on the other hand, milk supplied to the KCC at the same producer price is cut right back to Q_{pd} . Since the installation of a uniform price between seasons, the magnitude of the seasonal fluctuation has increased dramatically. (No attempt is made in Figure 4 to indicate actual quantities.)

In 1969/70, for instance, the difference between the lowest monthly intake of milk by KCC and the highest was 29 percent. In 1973/74, when the effect of the uniform price was beginning to be felt, the difference between the lowest and the highest monthly intake was well over 100 percent. There is every indication that this difference will increase as farmers, quite rationally in a uniform price situation, concentrate their production on that period when their costs are particularly low. The most profitable husbandry practice under these circumstances is seasonal calving, so that milk production ceases altogether during the season when grazing is scarce and low in quality, and all milk production is concentrated in the season when fodder is plentiful and cheap. This would be the rational economic response if additional milk in the flush season has the same value as additional dry season milk.

As well as fixing the same producer price throughout the year, the KCC fixes a constant consumer price, P_c in Figure 4. Since the demand curve does not shift between seasons, a more or less constant quantity of milk Q_c is demanded by consumers. This is a quantity that shifts as the population of those who want, and can afford to buy milk shifts the demand curve. Since the price is fixed, however, there are no price-related movements along the demand curve. The existence of a wet season surplus is not conveyed to the consumer as a lower price, so consumption does not increase. In the dry season, once again, consumers will want to buy the same quantity, even if a deficit exists. The only thing that constrains them is the amount available.

The dry season deficit in milk supplies $Q_c - Q_{pd}$, has been experienced with increasing regularity since the introduction of the uniform producer price. Excess demand for any uncontrolled commodity results in an increase in price, curtailed demand, and increased production of that commodity. There is no surprise when tomatoes, potatoes or any other crops become scarce in the off season. In the case of milk, however, it is regarded as a scandal when supplies are not adequate for the demand at the fixed prices. Questions are asked in Parliament, crisis headlines appear in the newspapers and consumers as individuals and groups make representations to the government.

Producers, in the meantime, point to their costs of dry season production and rightly point out that the producer price P_p must be raised to P_{pd} if the quantity Q_c is to be supplied, and that they would lose money if they tried to maintain supplies of Q_c at the price P_p . In the last few years in Kenya, the government has responded to the milk producers and there

The only problem with the price increases that have been granted is that they have not only applied to supplies of dry-season milk, but they have also applied to supplies of a very different commodity, one that is not in short supply at all, and that is flush-season milk. The result of applying the increased price P_{pu} in the flush season is that flush season supplies Q_{pr} already substantially in excess of the whole milk demanded by consumers Q_c , are increased even further. Far from being able to sell the additional milk at a high price and with minimal processing costs as is possible in the dry season when milk is scarce, the KCC is unable to increase sales at all and must therefore put all the additional intake into manufacturing milk products that are not perishable. The costs of manufacturing alternative products from this surplus milk are considerably higher and, of even greater significance, the value of additional supplies of such products per litre of milk used is very substantially lower than is the case for fluid milk. For the majority of manufactured milk products in fact, the 'realized price' per litre (the value of the product produced from one litre of fluid milk net of the manufacturing costs) is less than the price that the KCC must pay for the milk. This is particularly true when it is realized that during the dry season when the supply of fluid milk is low the entire processing facility of the KCC must remain idle. Unless milk is to be thrown out, however, processing facilities must be adequate to handle the maximum amount of milk that is delivered during the flush season. Underutilized equipment has far higher costs per unit of throughput than equipment that is utilized at a high and constant level, and milk processing equipment is no exception. The result is that additional fluid milk intake increases the financial losses of the KCC.

Faced with increasing financial losses due to its obligation to buy all the milk presented by the farmers, and the fact that it loses money on every additional flush season litre it buys, the KCC takes the only remedy that appears possible, an increase in the price of fluid milk to the consumer. The KCC is already making major profits in the fluid milk market, but its monopoly position in the principal urban areas, where it has effectively banned all other milk suppliers, means that it can raise the price and increase its fluid milk profits even further.

The price elasticity of demand for milk among low income consumers is high, so that a more than proportionate decrease in demand is the result of a price increase, with the result that total revenue falls. The consumers served by the KCC, however, consist principally of the relatively high income

populations appears to be less than unity. The result is that, while there is some dropping off in demand, total KCC revenues from the sale of milk increase as a result of a price increase. The lower income consumers drop out of the market, the higher income consumers maintain their milk consumption levels, and KCC profits from fluid milk sales increase to offset the even greater losses incurred by having to divert more fluid milk to manufacturing.

Ironically, it is in a 'bad' year, when rainfall is less than usual and cattle feed is in short supply, that the KCC tends to make financial profits. In a high rainfall year, when feed supplies and flush season milk supplies are abundant, the KCC, with its current policies, is almost bound to make a loss.

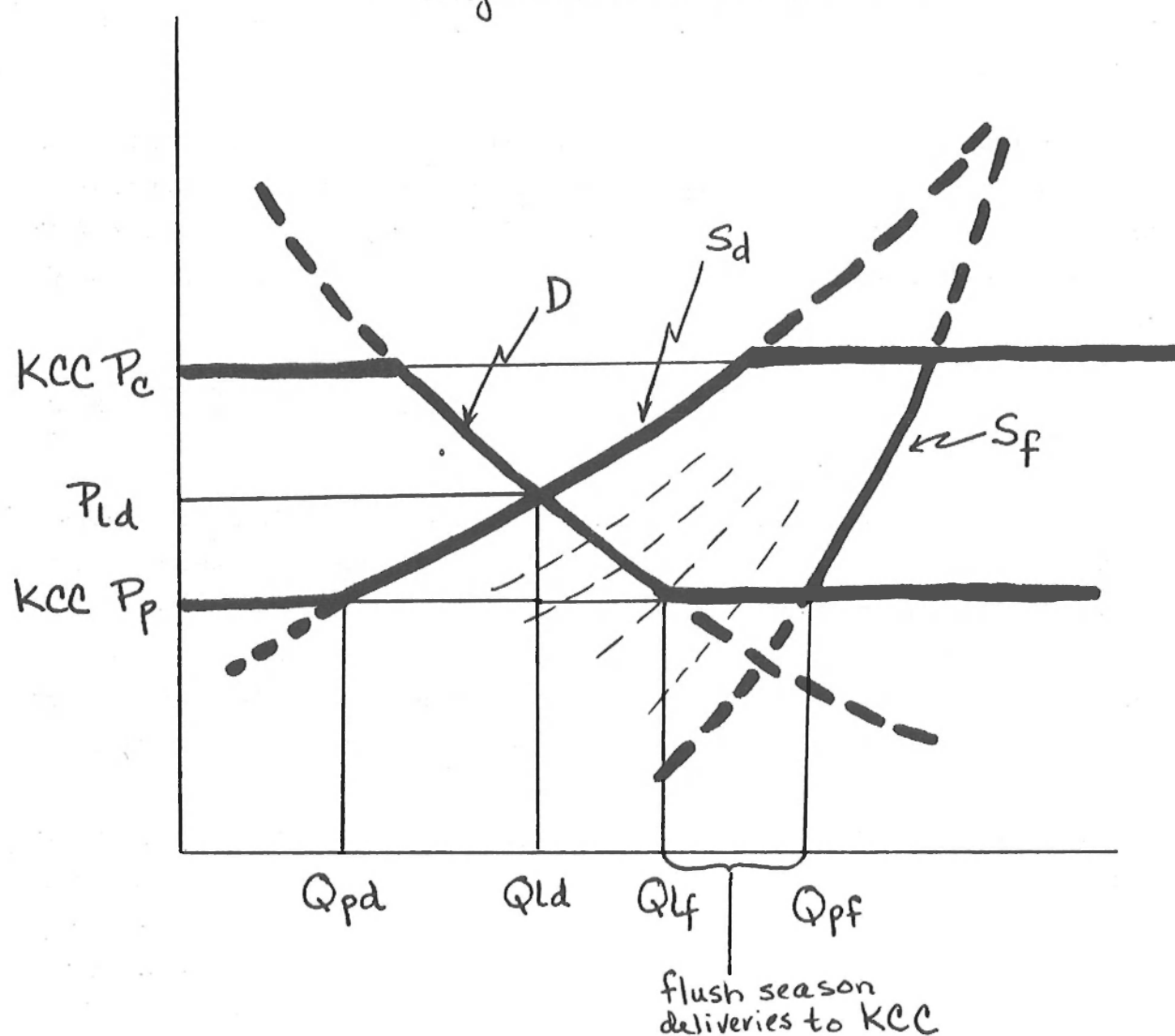
4.1. The Local Area Demand for Milk as an Additional Source of KCC Supply Fluctuation.

While milk production fluctuations between seasons from those farms that send virtually all their output to KCC is one source of seasonal supply fluctuations, very much greater supply fluctuations emanate from those areas where there is considerable local demand for milk. This is particularly the case in the more densely populated, predominantly small-farm areas where there is substantial local demand for milk. A uniform price for milk in these areas can be expected to result, in the extreme, in the drying up of KCC deliveries in the dry season, resulting in huge percentage increases in flush season supplies. The reason is that if the price in the local area is at or above the KCC producer price, net of transport costs to the KCC depot, producers will sell in the local area rather than to the KCC. The KCC is therefore the residual buyer, and only receives milk when the local demand, at the KCC producer price, has been fully met.

Figure 5 analyzes a local small-farm area in both its producing and consuming capacity. It will be noticed that the demand curve D has two kinks in it. If the price of whole milk in the local area goes up to P_c , the KCC selling price to consumers, it goes no higher because KCC milk can be bought at that price. If KCC milk is not available, the price rises along the top segmented section of the demand curve. If the price goes down as low as the KCC buying price from producers P_p , deliveries of any additional milk will be made to the KCC. Similarly,

Figure 5

KCC Supply Area with
Significant Local Demand



Note: There are no dry season deliveries to KCC.

if the KCC is unable or unwilling to collect the milk at that price, the price in the local area will fall and consumption will increase along the lower segmented tail of the demand curve.

In the case of the two supply curves, the same situation prevails so that prices stay within the limits set by the KCC producer and consumer prices, but can ~~move~~ move between them depending on local supply and demand.

In the dry season there is excess local demand for milk at the KCC producer price so that the price goes up to its equilibrium local dry season price P_{ld} . At this price, producers produce Q_{ld} quantity of milk, which is markedly more than the Q_{pd} amount they would have produced had the price stayed at the KCC producer price level P_p . Because producers can charge this higher price locally, no milk is delivered to the KCC.

As the supply curve shifts to the right with the onset of the rains, the price of milk in the local area declines and the quantity consumed increases until the price arrives at P_p , at which point the amount being consumed locally is Q_{lf} . At this producer price, P_p , meanwhile, flush season production goes up to Q_{pf} , which exceeds the quantity demanded locally at that price, and exceeds the quantity that would have been produced had the price been allowed to decline to its flush season equilibrium. A local flush season surplus is therefore generated which cannot be marketed in the local area without a decline in price. It is at this point that local farmers and coops make plans to deliver their surplus to KCC.

As far as KCC is concerned, an area that made no milk deliveries whatever in the dry season starts making deliveries in the flush season, precisely when KCC has surpluses that it can only handle at a loss. At the height of the flush season the local area depicted in Figure 5 is delivering $Q_{pf} - Q_{lf}$. In the dry season when additional milk is valuable and would add to KCC profits, the local area is delivering none at all. The proportional increase in the quantity delivered to KCC between the dry and the flush season is therefore infinite.

This pattern of delivering milk only in the flush season has now become commonplace for the more populated small-farm areas. Local cooperatives are rightly concerned with the incomes of their members and they will sell where the price is highest. In some areas, the dry-season price rises to the point that the area becomes a net importer rather than a net exporter of milk. Even for those areas where some dry-season deliveries to the KCC are made, however, (and Figure 5 could easily be redrawn to represent such a situation), the presence of a fixed local demand, Q_{lf} , which must be met before any deliveries are made to the KCC, means that the percentage change in deliveries between seasons is far higher than the percentage change in production. For example, if 15,000 litres per day are produced in one season and 11,000 in another and all

are delivered, the increase in deliveries from the dry to the flush season is 36 percent. If the same production fluctuation takes place but a delivery of 10,000 litres to the local market is maintained throughout, the change in KCC deliveries between the dry and wet seasons is 400 percent.

5. ECONOMIC IMPLICATIONS AND PROPOSALS

It is easy for government and parastatal officials to concentrate on the financial wellbeing and the growing role of their own organizations and to regard this, rather than increasing welfare in general, as the aim of economic policy. However, neither the objective of economic growth nor the objective of improved income distribution is well served by government regulations and institutions that result in the misallocation of economic resources and the kinds of subsidies and taxes that are the result of present milk pricing policies. Commercial dairy farmers tend to be among the most wealthy in their area. Current pricing policies result in very large rewards for totally excessive flush season production among such producers. They also curtail the consumption of the relatively poor members of the population who would consume more milk if the price came down. In the meantime, this overpriced flush season milk becomes the reason why the KCC cannot maintain its financial viability, and the reason why it raises its price for fluid milk until it becomes too expensive for the low-income urban consumer.

Consumers are ready to pay a price for milk in the dry season that would stimulate producers to raise production substantially (even when all processing and distribution costs are considered). The KCC, however, even though it could still make large profits in the dry season, when virtually all milk is sold as fluid milk, is unwilling to pay more for dry-season production. It is currently paying far too much for flush-season production, and not enough for dry-season production.

Two clear proposals for rectifying the worst anomalies in the pricing system can now be made. The first is that a locational differential in price should be instituted so that the price paid to producers in surplus areas reflects the costs of transporting the additional milk to the consuming areas. The second is that a seasonal price differential should be instituted so that the price at any time reflects the economic value of additional milk at that time. One way of achieving this is to vary the price according to the proportion of milk taken in that the KCC sells as fluid milk. As that proportion declines, indicating a surplus of fluid milk so that additional

indicating to farmers that additional expenditures should not be undertaken to increase supplies, and indicating to consumers that milk at that point is relatively abundant. Even if the KCC selling price remained constant, the flush season decline in the producer price would increase milk consumption in the rural areas and local markets where consumers are poor and the demand for milk is elastic. It would not effect KCC sales in the relatively high income urban markets. The overall result would be a decrease in flush season surpluses, the main cause of KCC's financial problems, and an increase in welfare, especially among the rural poor.

Pricing innovations of this sort would have the significant advantage of preserving the financial viability of the KCC and putting its internal accounting on a more rational and viable basis. The danger presented by the deficits it is currently accumulating is that the government will be under pressure to make them good. A massive subsidy of this sort to rescue the KCC from the consequences of irrational pricing policies contributes to neither income distribution nor growth objectives. It merely encourages the notion that the government is willing to tax the economy both by an inappropriate pricing policy and by paying for the financial consequences of such a policy. It would be ironic if the political power of dairy farmers, and the ability of government and parastatal officials to ignore economic and financial considerations in their decision-making, conspired to both undermine the efficient operation of a major industry and to tax the rest of the economy in this fashion.